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THE IMPORTANCE OF THIS FUNGUS IN KANSAS.

It is difficult to state of what economic importance this disease will prove to be in Kansas. In some of the southeastern states it is causing considerable damage. The important factors involved, as far as this state is concerned, are, that *Physoderma* occurs in Kansas, and indications are that it can live over as far north as this region. Further investigations of this disease in the state will be made.

In our scheme of classification, this fungus is placed in the order, *Chytridiales;* sub-order, *Mycochytridiineæ;* family, *Cladochytriaceæ,* along with such genera as *Urophlyctis, Cladochytrium,* etc.

- Class. *Archemycetæ.*
  - Ord. *Chytridiales.*
    - Sub. ord. *Mycochytridiineæ.*
      - Fam. *Cladochytriaceæ.*
        - Genus. *Physoderma.*

Laboratory of Plant Pathology, Agricultural Experiment Station, Manhattan.

Plant Disease Report for Kansas, 1917.

L. E. Melchers, Plant Pathologist, Kansas State Agricultural College, Manhattan.

CEREAL DISEASES.

Bunt of Wheat. *Tilletia fœtens* B. & C. Among the wheat diseases occurring in 1917, bunt was given more attention than usual. This was made possible in connection with the seed survey situation of the state. The counties where bunt was located in greater or less quantities were Reno, Stafford, Rice, Pratt, Harper, Dickinson, Barber, Norton, Chase, McPherson and Sumner. The majority of fields that showed the presence of bunt contained from two to five per cent, but many showed as high as twenty-five per cent.

Loose Smut of Wheat. *Ustilago tritici* (Pers.) Jens. This smut is more commonly and widely distributed over the state than bunt, but always appears in much smaller quantities. Generally from a trace (less than one-fourth per cent) to one and one-half per cent loose smut can be found in the great majority of wheat fields in Kansas. Occasionally a field has been found to contain as high as twenty-five per cent infection, but this is rare.

Black Chaff and Stem Disease of Wheat. *Bacterial.* The disease here described seems to be causally bacterial, although further work is necessary to prove the entire life history of the disease in question. This disease was given its common name by the writer in 1915. It was under experimentation by the writer in 1914, but the first newspaper article was published in 1915. Since this disease has been under observation, it was the worst in 1915. At that time excessive rains and the humid atmosphere made it favorable for its maximum development. Apparently this trouble has been most conspicuous in this state, at least as far as the "neck," head and glume infection is concerned. The blackened areas on the "neck" of the wheat plants, together with the spots or stripes of black on the glumes, make it conspicuous at heading time. A symptom more or less directly connected with the disease is the exuding of droplets from infected areas. Some seasons the seed of infected plants becomes shrivelled, but the extent of damage and the prevalence of this disease in Kansas seems quite dependent upon certain weather conditions. A bacterial trouble closely associated with this occurs on the foliage, but prior to the black chaff and stem disease symptoms on the wheat heads. Whether this is all one and the same disease is not definitely known. The black chaff and stem disease of wheat was observed in many places in the state in 1917, but was most abundant in Manhattan. Practically no loss was sustained in the fields where it occurred this year.

Stem Rust of Wheat. *Puccinia graminis tritici.* Only slight infections of stem rust were recorded in the state the past season. No fields showed more than a trace.

Leaf Rust of Wheat. *Puccinia triticina* Erikss. This was present everywhere on the leaves of the wheat crop at heading time. In many localities it did not appear in the fall of 1916.

Covered Smut of Barley. *Ustilago hordei* (Pers.) K. & S. This disease occurs quite consistently in most fields of barley, where seed treatment has not been given. The average per cent of this fungus in the field is about four.

Loose Smut of Barley. *Ustilago nuda* (Jens.) K. & S. This fungus is more abundant in the barley crop than the loose smut of wheat is in the wheat crop. The loose smut of barley is generally found in every barley field, the percentage running close to four per cent for an average.

Leaf Rust of Barley. *Puccinia simplex* Erikss. & Henn. This is the most uncommon of the cereal leaf rusts in the state. Generally small amounts can be found each season.

Loose Smut of Oats. *Ustilago avenæ* (Pers.) Jens. This disease is the most common of the oat diseases. It is very common to find eight per cent of the crop affected with loose smut. Since oat seed treatment is becoming more generally used, the losses are not as great as they formerly were.

Covered Smut of Oats. *Ustilago levis* K. & S. Magn. This smut likewise occurs in this state, but not as commonly as the loose smut. Both oats smuts can frequently be found in the same field.

Blade Blight of Oats. *Bacterial.* What seems to be a bacterial disease of oats was rather conspicuous the past season. Whether this is the same as the organism described by Manns[1] is not known. Distinct bacterial infections can be noticed. Sometimes this is accompanied by a reddish coloration of the foliage.

Leaf Rust of Oats. *Puccinia lolii avenæ* McAlpine. This rust was present in moderate amounts the past season. No damage to the crop was reported.

Rye. (*Bacterial disease.*) A conspicuous trouble was noticed on the rye crop the past season. Droplets of bacterial ooze were noticed on plants in the field. These droplets were found exuding from all parts of the stems. No apparent injury occurred.

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[1] Manns, T. F. Ohio Bull. 210, 1909.

Leaf Rust of Rye. *Puccinia dispersa* Erikss. This leaf rust is very common in the state and was present in normal quantities the past season.

Kernel Smut of Sorghum. *Sphacelotheca sorghi* Lk. This smut is always present in Kansas in greater or less quantities. In many fields five per cent of the heads are affected and it is not unusual to find fields showing fifty per cent smutted.

Head Smut of Sorghum. *Sphacelotheca reiliana* Lk. The head smut of sorghum has been reported from several places in the state the past season. Although it has never been present in alarming quantities, the past season showed that under proper conditions it appears to live over in this region. Considerable head smut of sorghum was reported from Stockton. It has also been reported from Finney county.

Bacterial Sorghum Spot. *Bacillus sorghi.* Considerable leaf-spot of the sorghums is present every season. This has been said to be due to a bacterial trouble, but how much is due to other causes and factors is still an open question.

Corn Smut. *Ustilago zeæ* (Beck.) Ung. Corn smut was the most prevalent that it has been for years. It was not uncommon to find fields that showed as high as fifty and seventy-five per cent of smut. The yield was considerably reduced by the presence of so large an amount. Less smut occurred in the southern and eastern part of the corn belt, while more smut occurred in the east central part and northern region. In the vicinity of Manhattan anywhere from twenty-five to sixty per cent was found.

New Corn Disease. *Physoderma* (*zeæ-maydis?*). This fungus was first found by the writer in 1915, when it occurred in considerable quantities at Manhattan. It causes reddish-brown or chocolate ruptures in the later stages of development, but when first noticed it produces blackened, small spots or blotches, not unlike the injury caused by aphids. The main ribs of the leaves, sheaths and nodes may be attacked. A shredded condition at the base of the leaves is a common symptom of this fungus. *Physoderma zeæ-maydis* was located in the following places the past season: At Manhattan it was the most prevalent of any place visited in the state. It also occurred in lesser quantities in fields around Chetopa and Iola. A trace was found at Garnett, Ottawa and Marysville.

Rust of Maize. *Puccinia sorghi* Schw. This is generally present every year. The past season it seemed to be more prevalent than usual.

Stem Rust of Timothy. *Puccinia phlei-pratensis* Erikss. & Henn. A few reports were received of slight infections of timothy rust, but the amounts were very slight. In 1916, however, severe infection occurred in fields of timothy.

Root Rot of Alfalfa. *Rhizoctonia violaceæ.* This root disease of alfalfa is quite serious in many alfalfa fields over the state, particularly if fields have been in alfalfa too long. Plants die out in spots, the disease spreading from year to year by carrying over on decaying roots. Plants affected turn yellow, wilt and gradually die. If the roots are examined, a violet colored mass of mycelium will be found, after which the disease has been named "violet root rot."

Leaf-spot of Alfalfa. *Pleosphærulina briosiana* Pol. This is the disease reported by Melchers[1] in 1915. It occurred in small quantities the past season. Causes greyish-brown, irregular spots on the foliage.

Leaf-spot or Blotch of Alfalfa. *Pyrenopeziza medicaginis* Fcl. This leaf-spot was described by the writer in 1915-'16 as *Phyllosticta medicaginis.*[2] It proved very prevalent during those years and considerable loss was sustained. It was not common, however, in 1917. This spot on alfalfa foliage is best described by calling it a "blotch" disease, rather that a leaf-spot. The affected leaves become more or less yellowish in color and the fruiting bodies are easily detected in the yellowish areas. No dead areas are caused, as is common in the leaf-spots, but the entire foliage assumes a sickly, sulphur-yellowish color or tinge. In severe cases the growth of affected plants is considerably impaired.

Alfalfa Stem Disease. *Phoma sp.* This disease has been observed since 1915, and indications are that it has been in the state a good many years. The stems of the alfalfa plant show dark areas, which in severe cases cause more or less drying of the stalks.

VEGETABLE DISEASES.

Black Scurf of Potato. *Rhizoctonia solani* Kühn. This disease was very severe in Kansas in 1917. Many fields contained from one to twenty-five per cent. The infection is carried on the seed, which if not given a seed treatment before planting will kill the young sprouts.

Black Leg of Potato. *Bacillus phytophthorus* Appel. This disease is found in many fields in the state, but very frequently a *Fusarium* infection is associated with it. Young sprouts die at the base, where a soft rot of the stems occurs. Infected seed is the source of the trouble.

Tip Burn of Potato. *Non-parasitic.* This malady and sun scald are two of the worst troubles affecting potatoes in Kansas. The lack of soil moisture at the proper time, together with transpiration factors in the plant, are apparently responsible for this injury. Potato vines may burn entirely brown and dry before the crop is mature. Tip burn is generally confined to the margins of the leaves, which turn brown, dry, and are materially injured. This is most common during the dry weather in July.

Sweet Potato Stem-rot. *Fusarium batatis* Wolb. and *Fusarium hyperoxysporum* This disease, which may be caused by either of the *Fusaria* species, is common in the state. Most sweet potato fields have more or less of this disease in them. The foliage of the diseased plant turns yellowish and wilts. Infection enters through the roots and blackens the vascular system. The potatoes show the disease at the place of attachment. By making cross sections of the roots, the blackened streaks of infection can be seen.

Sweet Potato Soil Rot or "Pox" Disease. *Cytospora batata* Elliot. This disease was reported for the first time this season in the state. It has probably been here for two or three years and in all probability came here with infected seed. It causes pits or "pox" spots in the tubers, which disfigure them for market purposes. These injuries are produced by one of the slime mold organisms, *Cytospora batata*. The "pox" injuries also afford opportunity for the entrance of secondary infections of black rot of sweet potato. Many specimens showed a combined infection of these diseases.

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[1] Melchers, L. E. A New Alfalfa Leaf-spot in America. Science, n. s., 42:536-537, 1915.

[2] Melchers, L. E. Plant Diseases Affecting Alfalfa. Rpt. Kans. State Board of Agri., 35:339-353.

Bean Anthracnose. *Colletotrichum lindemuthianum* (Sacc. & Magn.) Scribn. On account of the large acreage of beans grown the past season, considerable anthracnose appeared, particularly since most of the seed was imported. Young plants showed lesions when only four or five inches tall, and as a result many plants died. The latter part of the season was not favorable for anthracnose development, and not very much evidence was found on the bean pods.

Cabbage Yellows. *Fusarium conglutians* Wr. Only one report of this disease was called to the writer's notice. The plants were doing poorly, turning yellow, and the leaves were dropping.

Black Spot of Pepper. *Alternaria sp.* In 1915 the writer noticed, for the first time, a serious trouble attacking various varieties of peppers. This disease has been present every season since. It causes large black sunken areas or spots on the fruit. The fruit is destroyed for commercial purposes. The disease seems to be a combination of sun scald and fungus injury. There is a marked difference in varietal susceptibility, the Chili peppers not being susceptible.

Blossom Drop of Tomato. *Non-parasitic.* The cause of this malady has not been determined. It is present in the state in greater or less amounts every season. Tomato plants are apparently vigorous and appear to be thrifty, but the blossoms drop. Many causes have been proposed but the real factors are problematical. Considerable loss of fruit is the result.

Blossom-end-rot of Tomato. *Cause not known.* Very little of this disease was present last season. The wet weather in August may have been responsible for this. In this disease the blossom-end of the fruit turns black and decays or appears water-soaked. The disease appears when the tomatoes are about half grown. Affected fruit cannot be used.

Bacterial Wilt of Cucumber. *Bacillus tracheiphilus* E. Smith. This disease is most common on the cucumbers, but occasionally occurs on melons in this state. Plants may be affected when only a few inches tall, or they may develop to the runner stage and then wilt. The bacteria are transmitted for the main part by insects, particularly the striped cucumber beetle, which attack the plants.

FRUIT DISEASES.

Anthracnose of Melons. *Colletotrichum lagenarium* (Pass.) Ell. & Hals. This occurs to a greater or less extent every season on the watermelons, and to a lesser extent on muskmelons. The foliage is not so often attacked.

Raspberry Anthracnose. *Glœosporium venetum* Speg. This disease is rather common in the state wherever these brambles are grown. Attacks the canes, causing grayish spots, which are somewhat roughened. In severe cases it causes the canes to crack. Foliage shows small leaf-spots.

Orange Leaf Rust of Blackberry. *Gymnoconia interstitialis* (Schl.) Lagh. This disease is found more or less every season. Attacks both blackberry and raspberry. Whole plants may be destroyed. The orange-colored rust spores crop out from the leaves and young shoots, which are infected.

Strawberry Leaf-spot. *Mycosphærella fragariæ* (Schweinitz) Lindau. Commonly found wherever these berries are grown. Causes small, deep purple, or red spots, generally first observed on the upper surface of the leaves. No particular damage results to the berry crop in this state.

Apple Blotch. *Phyllosticta solitaria* E. & E. This disease was present in average amounts. Occurs in every county in the state where apples are grown. Attacks the fruit, leaves and twigs.

Apple Bitter Rot. *Glomerella cingulata* (Stoneman) Sh. and von Sch. This disease was present in very small quantities along the Missouri border.

Illinois or Apple Blister Canker. *Nummularia discreta* Tul. This disease is by far the worst of any of the apple diseases in the state. Most common in run-down orchards. Occurs in every county where apples are grown extensively. Attacks only the woody parts of the tree and is confined to limbs one inch or larger in diameter.

Black Rot of Apple. *Physalospora cydoniæ* Arnaud. This disease occurs on fruit, foliage and limbs of the apple tree in Kansas. It is most common on fruit that has already been injured mechanically or through insect puncture. It is quite common on the foliage, where the frog-eye markings are quite prominent. The cankers of black rot are generally found where the wood has been injured by sun injury or otherwise. Such cankers are a source of infection for a number of seasons.

Apple Scab. *Venturia inæqualis* (Cooke) Winter. This fungus was less conspicuous in 1917 than in 1916. Its presence on fruit and foliage was not very prominent, not even in unsprayed orchards. Climatic conditions are not generally favorable for its development in this state.

Spur Blight of Apples. *Bacillus amylovorus* (Burr.) Trev. There was less spur blight of apples than usual the past season. Pear blight was present in usual amounts.

Blossom-end-rot of Apples. *Alternaria sp.* This disease was observed for the first time the past season. The blossom-end of the apple turns black, involving an area generally of one-half inch. The symptoms appear as though they could be caused by spray burn. Frequently small radiating cracks go out from the blackened areas. Black rot was found associated with this injury sometimes, but the cause of the primary injury is not *Physalospora cydoniæ* Arnaud. An *Alternaria* may be the primary cause, but this is not definitely known.

Cedar Apple Rust. *Gymnosporangium juniperi-virginianæ* Schw. This fungus is present every season in regions where both the apples and red cedar are grown. It is rather rare to find the fruit of the apple affected in this state. The foliage of the apple tree is the only part of the host attacked.

Brown Rot of Stone Fruits. *Sclerotinia cinerea* (Bon.) Schrot. This disease was only reported on plums the past season, but no doubt it occurred on cherries and peaches where there was a crop. Little twig injury has ever been observed and cankers on peach are rare.

Cherry Fruit Disease. *Bacterial.* Two reports came to the writer's attention the past season, where a new cherry fruit trouble seemed to be causing damage. The fruit showed indications of a bacterial infection, being attacked when about half grown. The cultures obtained, however, did not give positive results upon inoculation. Further work is necescary to prove its real cause.

Peach Leaf Curl. *Exoascus deformans* (Berk.) Fckl. This was present in very limited quantities the past season on the foliage of the peach tree. In this state only the foliage is attacked.

Red Cedar Blight. *Phoma sp.* This made its appearance in 1916 for the first time in the cold frames of the nursery. Seedlings began dying at the tips. The symptom was a regular blight and frequently involved the entire seedling.

WINTER INJURY TO PLANTS.

As a whole, considerable winter injury occurred to evergreens and deciduous trees over the state. It was particularly serious among the cedars in many cases, and hedges and trees were severely injured. Later in the season the plants outgrew this. The injury was prevalent in many cases on the north or northwest exposure.

Agricultural Experiment Station, Manhattan.

Water Relations of Corn and the Sorghums.

Edwin C. Miller.

The statement that the sorghum plants produce a crop of both forage and grain under conditions that are prohibitive to the growth and maturity of the corn plant, needs no explanation to a Kansas audience. That the sorghums have been one of the most potent factors in the development of dry farming in the central and southern portion of the great plains during the past fifteen years, is unquestionable.

A knowledge of the characters that enable these plants to grow and develop under the conditions of the great plains, would be of value to those engaged in the breeding and development of plants for the semi-arid regions. In view of these facts, a series of investigations have been conducted during the past four years, in order to determine the fundamental characteristics possessed by the sorghum plants, which enable them to withstand severe climatic conditions better than the corn plant. These experiments were carried on at the State Branch Experiment Station at Garden City. This station is well suited for an experiment of this type, since the severity of the climatic conditions during the summer months is exceeded little or not at all by any other point in the great plains area. It is intended in this paper simply to summarize the results that have thus far been obtained in these experiments.